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EXAMINER	
THOMPSON, JAMES A	
ART UNIT	**PAPER NUMBER**
2624	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/688,610	DONOVAN ET AL.	
	Examiner	Art Unit	
	James A. Thompson	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 August 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-42* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-42* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 October 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)
2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3)☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *8/16/05*.
4)☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5)☐ Notice of Informal Patent Application (PTO-152)
6)☐ Other: _____.

DETAILED ACTION

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 16 August 2005 has been entered.

Response to Arguments

2. Applicant's arguments filed 16 August 2005 have been fully considered but they are not persuasive.

Firstly, the present amendments to the claims overcome the prior art rejections presented in the previous office action, dated 23 December 2004. However, additional prior art has been discovered which renders the present claims obvious to one of ordinary skill in the art.

Secondly, in response to Applicant's remarks on page 19-21, Examiner's suggestion in the telephone interview was not based on Chisum or the principle of "aggregations". The principle Examiner was addressing involves the well-established principle based on *In re Harza* (274 F.2d 669, 124 USPQ 378 (CCPA 1960)) in which a mere duplication of parts does not patentably distinguish claims over the prior art unless a new and unexpected result is produced. *In re Harza* is still accepted and has not been discarded as a legal basis of obviousness rejections. Applicant is referred to MPEP §2144.04 VI.B. For printers such as inkjet printers which are easily addressable by

computer processing means, increasing the number of the printing elements merely involves duplicating the number of printing elements and using a greater number of bits for the address space to access each print element. In order to demonstrate the non-obviousness of a duplication of parts, one must demonstrate some novel and unexpected result or attribute generated by said duplication of parts. While Applicant states that, "when the quantity of old elements added is <u>orders of magnitude</u> greater than originally, the result is a strongly <u>qual</u>itative (not "merely" quantitative) change in behavior" [page 20, lines 14-17 of Applicant's present arguments], Applicant must still demonstrate the alleged qualitative change and not merely rely upon analogies. While analogies [such as on page 20, lines 18-29 of Applicant's present arguments] are useful for illustration, analogies alone are not sufficient. Applicant's analogy relating to a change in orders of magnitude of the size of a person does not hold in this case since the principles involved are different than the principles involved in computer technology. The principles are based primarily on the relationship between height and how much a person would weigh, which is roughly proportional to the cube of the height, versus how much a scaled-up or scaled-down human bone structure could support, which is roughly proportional to the square of the height. Whereas the relevant computer technology principles are addressability and the complexity of interconnections, the principles involved in Applicant's analogy are related to structural mechanics and stresses, such as the principles involved in the construction of bridges and buildings.

Furthermore, certain aspects of computer equipment, such as addressable printer nozzles, addressable memory locations,

multiple disk drives, etc., can easily be duplicated by orders of magnitude and still be a mere duplication of parts. For example, an increase from 1MB of computer RAM to 100MB of computer RAM *per se* is a mere duplication of computer memory. In order to demonstrate non-obviousness of part duplication, one must demonstrate that the increase in memory causes an novel and unexpected result, which in this case would not be true since one of ordinary skill in the art would clearly expect the computer system to have more available memory for user access. Instead, the hypothetical applicant would need to amend the claims to claim the feature(s) that allow for the increase of memory, such as better semiconductor elements, more efficient addressing schemes, or whatever other feature(s) is/are the novel memory-increasing feature(s).

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 34-36 are rejected under 35 U.S.C. 102(b) as being anticipated by Hackleman (US Patent 5,847,722).

Regarding claim 34: Hackleman discloses at least one multi-element incremental (column 3, lines 32-37 of Hackleman) printing array (figure 3 of Hackleman) that is subject to colorant deposition error (column 3, lines 49-54 of Hackleman); means for measuring such colorant-deposition error of the at least one array (column 4, lines 37-41 of Hackleman); means for

modifying a multicolumn, multirow numerical tabulation (figure 3 (56) and column 4, lines 56-60 of Hackleman) that forms a mapping between such input image data and such marks, to compensate for the measured colorant-deposition error (column 6, lines 47-54 of Hackleman); and means for printing using the modified mapping (column 6, lines 52-54 of Hackleman), wherein the multi-element printing array is an inkjet printhead (column 3, lines 11-14 of Hackleman).

Regarding claim 35: Hackleman discloses measuring a pattern of print density defects (column 4, lines 37-41 of Hackleman) for at least one multi-element printing array (figure 3 of Hackleman) that is subject to printing density defects (column 3, lines 49-54 of Hackleman); and applying the correction pattern to modify a halftone thresholding process (column 6, lines 47-54 of Hackleman). Since a halftone thresholding process places dots at specific locations, modifying the location at which dots are placed (column 6, lines 47-54 of Hackleman) modifies a halftone thresholding process.

Hackleman further discloses printing such image using the modified halftone thresholding process (figure 1 and column 3, lines 14-24 of Hackleman), wherein the multi-element printing array is an inkjet printhead (column 3, lines 11-14 of Hackleman).

Regarding claim 36: Hackleman discloses measuring a parameter related to print-quality defects due to departure of printing-medium advance from an optimum value (figure 3 and column 3, lines 53-57 of Hackleman); and, based on the measured parameter, scaling such input image data to compensate for such departure (column 4, lines 56-62 of Hackleman). In order for the image data to be physically printed, said image data must

inherently be scaled to pixel grid of the printer. Each dot printed is of a specific size based on the physical characteristics of the print head and the image data is scaled so that it can be physically printed.

Hackleman further discloses printing such image using the scaled input image data (figure 1 and column 3, lines 14-24 of Hackleman), wherein the multi-element printing array is an inkjet printhead (column 3, lines 11-14 of Hackleman).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-15, 18, 22-30, 33 and 37-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hackleman (US Patent 5,847,722) in view of Koike (US Patent 5,988,790).

Regarding claim 1: Hackleman discloses at least one multi-element printing array (figure 3 of Hackleman) that is subject to colorant deposition error (column 3, lines 49-54 of Hackleman); means for measuring such colorant-deposition error of the at least one array (column 4, lines 37-41 of Hackleman); means for modifying a multicolumn, multirow numerical tabulation (figure 3(56) and column 4, lines 56-60 of Hackleman) that forms a mapping between such input image data and such marks, to compensate for the measured colorant-deposition error (column 6,

lines 47-54 of Hackleman); and means for printing using the modified mapping (column 6, lines 52-54 of Hackleman).

Hackleman does not disclose expressly for each colorant, at least one respective multielement printing array.

Koike discloses for each colorant, at least one respective multielement printing array (figure 10; column 11, lines 35-40; and column 14, lines 47-51 of Koike). Each nozzle of the individual printhead (figure 10 and column 14, lines 47-51 of Koike) is an element of a multielement printing array (column 14, lines 51-58 of Koike). If there are multiple colors (column 11, lines 35-40 of Koike), there are still many more nozzles than printing colors (figure 10 and column 11, lines 35-40 of Koike), thus there is a multielement printing array for each colorant, each array corresponding to the nozzles used for each particular color.

Hackleman and Koike are combinable because they are from the same field of endeavor, namely the control and correction of printheads and printing nozzles. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a multielement printing array for each respective colorant, as taught by Koike. The suggestion for doing so would have been that the multielement printing array taught by Koike is naturally adaptable to color printing (column 11, lines 38-40 of Koike). Therefore, it would have been obvious to combine Koike with Hackleman to obtain the invention as specified in claim 1.

Regarding claim 2: Hackleman discloses that the mapping is selected from the group consisting of an optical-density transformation of the image data to such construction from individual marks (column 4, lines 37-39 and lines 43-49 of

Hackleman); and a spatial-resolution relationship between the image data and such pixel grid (column 4, lines 56-62 of Hackleman).

Regarding claim 3: Hackleman discloses that the optical-density transformation comprises a halftoning matrix (column 4, lines 46-52 of Hackleman). By measuring based on the precise pixel positions (column 4, lines 46-52 of Hackleman), the halftoning matrix - specifically the pixel positions comprising the halftoning matrix - are used as part of the optical-density transformation.

Hackleman further discloses that the spatial-resolution relationship comprises a scaling of the image data to such pixel grid (column 4, lines 56-62 of Hackleman). In order for the image data to be physically printed, said image data must inherently be scaled to pixel grid of the printer. Each dot printed is of a specific size based on the physical characteristics of the print head and the image data is scaled so that it can be physically printed.

Regarding claim 4: Hackleman discloses that each multi-element printing array (figure 3 of Hackleman) is subject to colorant deposition error (column 3, lines 49-54 of Hackleman); and the measuring means and the mapping-modifying means each operate with respect to each one of the plurality of multi-element printing arrays respectively (column 4, lines 39-43 and lines 53-56 (measuring means); and column 6, lines 47-54 (map-modifying means) of Hackleman).

Hackleman does not disclose expressly that said at least one multi-element printing array comprises a plurality of multi-element printing arrays that print in a corresponding plurality of different colors or color dilutions, respectively.

Koike discloses that said at least one multi-element printing array (figure 10 and figure 11(b) of Koike) comprises a plurality of multi-element printing arrays that print in a corresponding plurality of different colors or color dilutions, respectively (column 11, lines 35-40 and column 15, lines 51-61 of Koike). Each nozzle of the individual printhead (figure 10 and column 14, lines 47-51 of Koike) is an element of a multielement printing array (column 14, lines 51-58 of Koike). If there are multiple colors (column 11, lines 35-40 of Koike), then there is a multielement printing array for each colorant, each array corresponding to the nozzles used for each particular color.

Hackleman and Koike are combinable because they are from the same field of endeavor, namely the control and correction of printheads and printing nozzles. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have the at least one multielement printing array comprise a plurality of multi-element printing arrays for each respective colorant, as taught by Koike. The suggestion for doing so would have been that the multielement printing array taught by Koike is naturally adaptable to color printing (column 11, lines 38-40 of Koike). Therefore, it would have been obvious to combine Koike with Hackleman to obtain the invention as specified in claim 4.

Regarding claim 5: Hackleman discloses that, for at least one of the plurality of multi-element printing arrays, the colorant-deposition error comprises a respective pattern of printing-density defects (figure 3 and column 3, lines 53-57 of Hackleman); that the measuring means comprises means for measuring the pattern of printing-density defects for each

multi-element printing array respectively (column 4, lines 37-41 of Hackleman); and that the modifying means comprises means for applying the respective pattern of defects, for at least one of the multi-element printing arrays, to modify a respective said mapping (column 6, lines 47-54 of Hackleman).

Regarding claim 6: Hackleman discloses that, for at least one of the plurality of multi-element printing arrays, the colorant-deposition error comprises a swath-height error (figure 3 and column 3, lines 53-57 of Hackleman); that the measuring means comprises means for measuring the swath-height error for each multi-element printing array respectively (column 4, lines 37-41 of Hackleman); and that the modifying means comprises means for applying the respective swath-height error, for at least one of the multi-element printing arrays, to modify a respective said mapping (column 6, lines 47-54 of Hackleman). A mis-alignment of printing includes both lateral and swath-height errors.

Regarding claim 7: Hackleman discloses that the colorant-deposition error comprises a respective pattern of printing-density defects (figure 3 and column 3, lines 53-57 of Hackleman); that the measuring means comprises means for measuring the pattern of printing-density defects (column 4, lines 37-41 of Hackleman); and that the modifying means comprises means for deriving a correction pattern from the measured pattern of printing-density defects (column 4, lines 53-60 and column 6, lines 47-50 of Hackleman), and means for applying the correction pattern to modify a halftone thresholding process (column 6, lines 47-54 of Hackleman). Since a halftone thresholding process places dots at specific locations, modifying the location at which dots are placed

(column 6, lines 47-54 of Hackleman) modifies a halftone thresholding process.

Hackleman further discloses that, for each colorant, the printing means comprises means for printing such image incrementally (column 3, lines 32-37 of Hackleman), using the modified halftone thresholding process (figure 1 and column 3, lines 14-24 of Hackleman).

Regarding claim 8: Hackleman discloses that the colorant-deposition error comprises a swath-height error or otherwise corresponds to an optimum distance of printing-medium advance (figure 3 and column 3, lines 53-57 of Hackleman); that the measuring means comprises means for measuring the swath-height error or determining the optimum distance (column 4, lines 37-41 of Hackleman); and that the modifying means comprises means for deriving a correction pattern from the measured swath-height error or determined optimum distance (column 4, lines 53-60 and column 6, lines 47-50 of Hackleman), and means for applying the correction pattern to modify a halftone thresholding process (column 6, lines 47-54 of Hackleman). Since a halftone thresholding process places dots at specific locations, modifying the location at which dots are placed (column 6, lines 47-54 of Hackleman) modifies a halftone thresholding process. A mis-alignment of printing includes both lateral and swath-height errors.

Hackleman further discloses that, for each colorant, the printing means comprises means for printing such image incrementally (column 3, lines 32-37 of Hackleman), using the modified halftone thresholding process (figure 1 and column 6, lines 47-50 of Hackleman).

Regarding claim 9: Hackleman discloses measuring a pattern of printing density defects (column 4, lines 37-41 of Hackleman); deriving a correction pattern from the measured pattern of printing density defects (column 4, lines 53-60 and column 6, lines 47-50 of Hackleman); and applying the correction pattern to modify a halftone thresholding process (column 6, lines 47-54 of Hackleman). Since a halftone thresholding process places dots at specific locations, modifying the location at which dots are placed (column 6, lines 47-54 of Hackleman) modifies a halftone thresholding process.

Hackleman further discloses, for each colorant, printing such image by said at least one multi-element array, using the modified halftone thresholding process (figure 1 and column 6, lines 47-50 of Hackleman).

Hackleman does not disclose expressly that each multi-element array is respective to each of said colorant.

Koike discloses that a plurality of multi-element printing arrays that print in a corresponding plurality of different colors or color dilutions, respectively (column 11, lines 35-40 and column 15, lines 51-61 of Koike). Each nozzle of the individual printhead (figure 10 and column 14, lines 47-51 of Koike) is an element of a multielement printing array (column 14, lines 51-58 of Koike). If there are multiple colors (column 11, lines 35-40 of Koike), then there is a multielement printing array for each colorant, each array corresponding to the nozzles used for each particular color.

Hackleman and Koike are combinable because they are from the same field of endeavor, namely the control and correction of printheads and printing nozzles. At the time of the invention, it would have been obvious to a person of ordinary skill in the

art to use a plurality of multi-element printing arrays for each respective colorant, as taught by Koike. The suggestion for doing so would have been that the multielement printing array taught by Koike is naturally adaptable to color printing (column 11, lines 38-40 of Koike). Therefore, it would have been obvious to combine Koike with Hackleman to obtain the invention as specified in claim 9.

Regarding claim 10: Hackleman discloses using a printmask to determine a relationship between the halftone matrix and the multi-element array (column 6, lines 47-54 of Hackleman). The misalignment information is a printmask since said information determines exactly when the printhead itself will print based on the halftone matrix, the image data itself, and the measured positions of the elements of the multi-element array.

Hackleman further discloses employing the relationship in the applying step to control application of the correction pattern to the halftone matrix (column 6, lines 52-54 of Hackleman).

Regarding claim 11: Hackleman discloses that the printing step comprises single-pass printing (figure 1 and column 3, lines 14-24 of Hackleman).

Regarding claim 12: Hackleman discloses that the measuring, deriving, applying and printing steps are employed to modify swath height of at least one of the scanning multi-element printing arrays, for accommodating any swath-height error present in each multi-element printing array respectively (figure 3; column 4, lines 37-41 (measuring and deriving); and column 6, lines 47-54 (applying and printing) of Hackleman). A mis-alignment of printing includes both lateral and swath-height errors.

Regarding claim 13: Hackleman discloses that the measuring, deriving, applying and printing steps are each performed with respect to each multi-element printing array respectively (column 4, lines 53-56 (measuring and deriving) and column 6, lines 56-59 (applying and printing) of Hackleman).

Regarding claim 14: Hackleman discloses that the measuring, deriving, applying and printing steps are also employed to modify swath height of at least one of the multi-element printing arrays, for accommodating any swath-height error present in each multi-element printing array respectively (figure 3; column 4, lines 37-41 (measuring and deriving); and column 6, lines 47-54 (applying and printing) of Hackleman). A mis-alignment of printing includes both lateral and swath-height errors.

Regarding claim 15: Hackleman discloses that the halftone thresholding process comprises definition of a halftone matrix (column 4, lines 31-36 of Hackleman). The precise alignment and positioning of where the ink dots are to be placed, *via* a firing of the print head nozzle, define a halftone matrix.

Regarding claim 18: Hackleman discloses that the applying step comprises replacing values above or below a threshold value (column 6, lines 60-64 of Hackleman). Since the timing signals of the printhead are adjusted, the placement of dots - and thus halftone locations - will be shifted. As is well-known and commonly practiced in the digital printing arts, halftoning is performed by printing a dot at a location based on a comparison of the pixel value at said location with a threshold. Therefore, if the dot placements are shifted, values above or below a threshold value are also shifted, and thus replaced at their respective points.

Regarding claim 22: Hackleman discloses that, for each of the plurality of multielement arrays, the measuring, deriving and applying steps are each performed at most only one time for a full image (figure 1 and column 3, lines 14-24 of Hackleman). Since the printer is a standard inkjet printer which functions by driving a sheet along a media path via a drive roller (figure 1 and column 3, lines 14-24 of Hackleman), the image is printed incrementally (column 3, lines 32-37 of Hackleman). Therefore, the measuring, deriving and applying steps can be performed no more than once for a full image.

Regarding claim 23: Hackleman discloses that the applying step comprises modifying the darkness of substantially each mark printed by an individual printing element whose density is defective (column 6, lines 60-64 of Hackleman). Since the timing signals of the printhead are adjusted, the placement of dots - and thus halftone locations - will be shifted. As is well-known and commonly practiced in the digital printing arts, halftoning is performed by printing a dot at a location based on a comparison of the pixel value at said location with a threshold. Thus, if the density of an individual printing element is defective at the location of a particular mark, then the darkness (whether black or white) will be modified based on said shifting.

Regarding claim 24: Hackleman discloses that the applying step comprises modifying the average number of dots printed by an individual printing element whose density is defective (column 6, lines 60-64 of Hackleman). Since the timing signals of the printhead are adjusted, the placement of dots - and thus halftone locations - will be shifted. As is well-known and commonly practiced in the digital printing arts, halftoning is

performed by printing a dot at a location based on a comparison of the pixel value at said location with a threshold. Thus, if the density of an individual printing element is defective at the location of a particular mark, then the average number of dots printed by an individual printing element will be modified based on said shifting.

Regarding claim 25: Hackleman discloses measuring a parameter related to print quality defects due to departure of printing medium advance from an optimal value (column 4, lines 53-60 of Hackleman); and, based on the measured parameter, scaling the input image data to compensate for said departure (column 4, lines 56-62 of Hackleman). In order for the image data to be physically printed, said image data must inherently be scaled to pixel grid of the printer. Each dot printed is of a specific size based on the physical characteristics of the print head and the image data is scaled so that it can be physically printed.

Hackleman further discloses printing such marks with at least one scanning multielement array (figure 3 and column 3, lines 49-54 of Hackleman) using the scaled input image data (column 6, lines 52-54 of Hackleman).

Hackleman does not disclose expressly that said at least one scanning multielement array is for each one of a plurality of colorants.

Koike discloses for each colorant, at least one respective multielement printing array (figure 10; column 11, lines 35-40; and column 14, lines 47-51 of Koike). Each nozzle of the individual printhead (figure 10 and column 14, lines 47-51 of Koike) is an element of a multielement printing array (column 14, lines 51-58 of Koike). If there are multiple colors (column

11, lines 35-40 of Koike), there are still many more nozzles than printing colors (figure 10 and column 11, lines 35-40 of Koike), thus there is a multielement printing array for each colorant, each array corresponding to the nozzles used for each particular color.

Hackleman and Koike are combinable because they are from the same field of endeavor, namely the control and correction of printheads and printing nozzles. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a multielement printing array for each respective colorant, as taught by Koike. The suggestion for doing so would have been that the multielement printing array taught by Koike is naturally adaptable to color printing (column 11, lines 38-40 of Koike). Therefore, it would have been obvious to combine Koike with Hackleman to obtain the invention as specified in claim 25.

Regarding claim 26: Hackleman discloses that the parameter comprises such print quality defects (figure 3 and column 3, lines 53-57 of Hackleman); and the measuring step comprises measuring such print-quality defects (column 4, lines 37-41 of Hackleman).

Regarding claim 27: Hackleman discloses that the defects comprise swath height error (figure 3 and column 3, lines 53-57 of Hackleman); and the measuring step comprises measuring swath-height error (column 4, lines 37-41 of Hackleman). A mis-alignment of printing includes both lateral and swath-height errors.

Regarding claim 28: Hackleman discloses that the defects comprise area-fill non-uniformity (figure 3 and column 3, lines 49-54 of Hackleman); and the measuring step comprises using a

sensing system to measure area-fill non-uniformity for plural printing-medium advance values (column 4, lines 53-60 of Hackleman), and selecting a printing-medium advance value that corresponds to minimum area-fill non-uniformity (column 6, lines 47-49 and lines 56-59 of Hackleman). Misalignment is measured (column 3, lines 49-54 of Hackleman) in terms of both the x- and y-directions (column 3, lines 17-24 of Hackleman), and thus in terms of area-fill non-uniformity. By correcting for the misalignment (column 6, lines 47-49 and lines 56-59 of Hackleman), the area-fill non-uniformity is minimized.

Regarding claim 29: Hackleman discloses that the parameter comprises such optimum value (figure 3 and column 3, lines 53-57 of Hackleman); and the measuring step comprises determining such optimum value (column 4, lines 37-41 of Hackleman).

Regarding claim 30: Hackleman discloses that the measuring, scaling and printing steps are each performed with respect to each multi-element printing array respectively (column 4, lines 53-56 (measuring) and column 6, lines 56-59 (scaling and printing) of Hackleman).

Regarding claim 33: Hackleman discloses, after the scaling step (column 4, lines 56-62 of Hackleman), iterating the measuring and scaling step to allow for non-linearity in such print-quality defects (column 4, lines 54-60 of Hackleman).

Regarding claim 37: Hackleman discloses, for each colorant, respective means for printing incrementally (column 3, lines 32-37 of Hackleman) in that colorant (figure 4(18-24) and column 3, lines 37-39 and lines 45-46 of Hackleman); at least one incremental (column 3, lines 32-37 of Hackleman) printing array (figure 3 of Hackleman) that is subject to colorant deposition error (column 3, lines 49-54 of Hackleman); means for

measuring such colorant-deposition error of the at least one array (column 4, lines 37-41 of Hackleman); means for modifying a multicolumn, multirow numerical tabulation (figure 3 (56) and column 4, lines 56-60 of Hackleman) that forms a mapping between such input image data and such marks, to compensate for the measured colorant-deposition error (column 6, lines 47-54 of Hackleman); and means for printing using the modified mapping (column 6, lines 52-54 of Hackleman).

Hackleman does not disclose expressly that each said printing means, for a particular one colorant comprises at least one respective said incremental printing array.

Koike discloses for each particular one colorant, at least one respective multielement printing array (figure 10; column 11, lines 35-40; and column 14, lines 47-51 of Koike). Each nozzle of the individual printhead (figure 10 and column 14, lines 47-51 of Koike) is an element of a multielement printing array (column 14, lines 51-58 of Koike). If there are multiple colors (column 11, lines 35-40 of Koike), there are still many more nozzles than printing colors (figure 10 and column 11, lines 35-40 of Koike), thus there is a multielement printing array for each colorant, each array corresponding to the nozzles used for each particular color.

Hackleman and Koike are combinable because they are from the same field of endeavor, namely the control and correction of printheads and printing nozzles. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a multielement printing array for each respective colorant, as taught by Koike, wherein each multielement printing array is an incremental printing array, as taught by Hackleman. The suggestion for doing so would have been that the

multielement printing array taught by Koike is naturally adaptable to color printing (column 11, lines 38-40 of Koike). Therefore, it would have been obvious to combine Koike with Hackleman to obtain the invention as specified in claim 37.

Regarding claim 38: Hackleman discloses at least one multi-element printing array (figure 3 of Hackleman) that is subject to colorant deposition error (column 3, lines 49-54 of Hackleman); means for measuring such colorant-deposition error of the at least one array (column 4, lines 37-41 of Hackleman); means for modifying a multicolumn, multirow numerical tabulation (figure 3 (56) and column 4, lines 56-60 of Hackleman) that forms a mapping between such input image data and such marks, to compensate for the measured colorant-deposition error (column 6, lines 47-54 of Hackleman); and means for printing using the modified mapping (column 6, lines 52-54 of Hackleman)..

Hackleman does not disclose expressly that said multi-element printing array is specifically a *multihundred*-element printing array.

Koike discloses multihundred-element printing arrays (figure 10; and column 14, lines 47-51 and lines 55-58 of Koike). Koike teaches a multi-element printing array (figure 10 and column 14, lines 47-51 of Koike) in general terms of M nozzles in the main scanning direction and N nozzles in the sub-scanning direction (column 14, lines 55-58 of Koike). For large enough values of M and N (e.g., M=20 and N=20), the multi-element printing array taught by Koike is clearly a multihundred-element printing array.

Hackleman and Koike are combinable because they are from the same field of endeavor, namely the control and correction of printheads and printing nozzles. At the time of the invention,

it would have been obvious to a person of ordinary skill in the art to use a multihundred element printing array, as taught by Koike. The suggestion for doing so would have been that the multihundred-element printing array taught by Koike is naturally adaptable to color printing (column 11, lines 38-40 of Koike) and the values of M and N can be whatever the printhead designer wishes (column 15, lines 5-12 of Koike). Therefore, it would have been obvious to combine Koike with Hackleman to obtain the invention as specified in claim 38.

Further regarding claim 39: Koike discloses that the multihundred-element array has at least three hundred printing elements (column 14, lines 55-58 of Koike). If, for example, $M \geq 15$ and $N \geq 20$, then the multihundred-element array has at least three hundred printing elements.

Regarding claim 40: Hackleman discloses at least one multi-element incremental (column 3, lines 32-37 of Hackleman) printing array (figure 3 of Hackleman) that is subject to colorant deposition error (column 3, lines 49-54 of Hackleman); means for measuring such colorant-deposition error of the at least one array (column 4, lines 37-41 of Hackleman); means for modifying a multicolumn, multirow numerical tabulation (figure 3 (56) and column 4, lines 56-60 of Hackleman) that forms a mapping between such input image data and such marks, to compensate for the measured colorant-deposition error (column 6, lines 47-54 of Hackleman); and means for printing using the modified mapping (column 6, lines 52-54 of Hackleman).

Hackleman does not disclose expressly that said printing array has at least thirty printing elements.

Koike discloses a printing array that has at least thirty printing elements (figure 10; and column 14, lines 47-51 and

lines 55-58 of Koike). Koike teaches a multi-element printing array (figure 10 and column 14, lines 47-51 of Koike) in general terms of M nozzles in the main scanning direction and N nozzles in the sub-scanning direction (column 14, lines 55-58 of Koike). For large enough values of M and N (e.g., column 15, lines 5-9 of Koike), the multi-element printing array has at least thirty printing elements.

Hackleman and Koike are combinable because they are from the same field of endeavor, namely the control and correction of printheads and printing nozzles. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a multi-element printing array that has at least thirty printing elements, as taught by Koike. The suggestion for doing so would have been that the multi-element printing array with at least thirty printing elements taught by Koike is naturally adaptable to color printing (column 11, lines 38-40 of Koike) and the values of M and N can be whatever the printhead designer wishes (column 15, lines 5-12 of Koike). Therefore, it would have been obvious to combine Koike with Hackleman to obtain the invention as specified in claim 40.

Further regarding claim 41: Koike discloses that the at least one multi-element incremental printing array comprises a scanning printhead or a full-page-width printhead (figures 10, 11a and 11b; and column 15, lines 29-40 of Koike).

Further regarding claim 42: Koike discloses that the printing means comprises at least one microprocessor controlling all of the at least thirty elements simultaneously during printing (figure 3(12) and column 9, lines 47-53 of Koike) to select, and selectively actuate, particular elements for

printing of particular pixels respectively (figures 10, 11a and 11b; and column 15, lines 32-45 of Koike).

7. Claims 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hackleman (US Patent 5,847,722) in view of Koike (US Patent 5,988,790) and Klees (US Patent 4,891,714).

Regarding claim 16: Hackleman in view of Koike does not disclose expressly that the halftone thresholding process comprises an error-diffusion protocol.

Klees discloses an error-diffusion protocol for halftone thresholding processes (column 2, line 64 to column 3, line 2 of Klees).

Hackleman in view of Koike is combinable with Klees because they are from the same field of endeavor, namely halftone image processing and output. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to specifically use an error-diffusion protocol, as taught by Klees. The motivation for doing so would have been to reduce truncation artifacts in image data signals (column 2, lines 19-22 of Klees). Therefore, it would have been obvious to combine Klees with Hackleman in view of Koike to obtain the invention as specified in claim 16.

Further regarding claim 17: Klees discloses that the error-diffusion protocol comprises at least one of a progressive error-distribution allocation protocol of such error-diffusion halftoning (column 2, line 67 to column 3, line 5 of Klees); and a decisional protocol for determining whether to mark a particular pixel (column 3, lines 22-24 of Klees).

8. Claims 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hackleman (US Patent 5,847,722) in view of Koike (US Patent 5,988,790) and Imao (US Patent 5,436,739).

Regarding claim 19: Hackleman in view of Koike does not disclose expressly that the applying step comprises multiplying values by a linear factor.

Imao discloses multiplying the image data values by a linear factor (figure 7A; column 6, lines 53-55; and column 7, lines 56-60 of Imao).

Hackleman in view of Koike is combinable with Imao because they are from the same field of endeavor, namely digital image data processing and printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to multiply the image values by a linear factor. The motivation for doing so would have been to be able to convert the image values from the input device to the corresponding values for the output printer (column 7, lines 56-60 of Imao). Therefore, it would have been obvious to combine Imao with Hackleman in view of Koike to obtain the invention as specified in claim 19.

Regarding claim 20: Hackleman in view of Koike does not disclose expressly that the applying step comprises applying a gamma correction function to values.

Imao discloses applying a gamma correction function to the image data values (column 3, line 66 to column 4, line 2 of Imao).

Hackleman in view of Koike is combinable with Imao because they are from the same field of endeavor, namely digital image data processing and printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to apply a gamma correction function to the image data values.

The motivation for doing so would have been to be able to eliminate non-linearities in the image data (column 3, lines 67-68 of Imao). Therefore, it would have been obvious to combine Imao with Hackleman in view of Koike to obtain the invention as specified in claim 20.

Regarding claim 21: Hackleman discloses that the applying step comprises replacing values above or below a threshold value (column 6, lines 60-64 of Hackleman). Since the timing signals of the printhead are adjusted, the placement of dots - and thus halftone locations - will be shifted. As is well-known and commonly practiced in the digital printing arts, halftoning is performed by printing a dot at a location based on a comparison of the pixel value at said location with a threshold. Therefore, if the dot placements are shifted, values above or below a threshold value are also shifted, and thus replaced at their respective points.

Hackleman in view of Koike does not disclose expressly that said applying step also comprises one of multiplying each values by a linear factor; and applying a gamma correction function to values.

Imao discloses multiplying the image data values by a linear factor (figure 7A; column 6, lines 53-55; and column 7, lines 56-60 of Imao); and applying a gamma correction function to the image data values (column 3, line 66 to column 4, line 2 of Imao).

Hackleman in view of Koike is combinable with Imao because they are from the same field of endeavor, namely digital image data processing and printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to additionally either multiply the image values by a linear

factor or apply a gamma correction function to the image data values. The motivation for doing so would have been to be able to either convert the image values from the input device to the corresponding values for the output printer (column 7, lines 56-60 of Imao) or eliminate non-linearities in the image data (column 3, lines 67-68 of Imao). Therefore, it would have been obvious to combine Imao with Hackleman in view of Koike to obtain the invention as specified in claim 21.

9. Claims 31-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hackleman (US Patent 5,847,722) in view of Koike (US Patent 5,988,790) and Cobbs (US Patent 5,600,350).

Hackleman in view of Koike does not disclose expressly comparing optimum advance values or swath-height values measured for the plurality of multielement printing arrays respectively, to find the smallest of said values; selecting a particular multielement printing array whose said value is substantially the smallest; using, in common for the plurality of printing arrays, substantially said selected smallest value; and for substantially each array other that the particular array, operating with a respective reduced number of printing elements and with rescaled data, to match an actual effective swath height of the particular array.

Cobbs discloses comparing optimum advance values or swath-height values (column 9, lines 48-52 of Cobbs) measured for the plurality of multielement printing arrays respectively (column 9, lines 55-60 of Cobbs), to find the smallest of said values (column 10, lines 4-9 of Cobbs); selecting a particular multielement printing array whose said value is substantially the smallest (column 10, lines 1-2 of Cobbs); using, in common

for the plurality of printing arrays, substantially said selected smallest value (column 10, lines 1-7 of Cobbs); and for substantially each array other that the particular array, operating with a respective reduced number of printing elements and with rescaled data, to match an actual effective swath height of the particular array (column 10, lines 4-9 of Cobbs). Phase difference is calculated (column 9, lines 38-42 of Cobbs) and used to correct the pen offsets by selecting the particular pens to use from among a plurality of pens (column 10, lines 1-7 of Cobbs), thus correcting the offset of the image (column 10, lines 7-9 of Cobbs). Since there are only particular pens to select (column 10, lines 4-7 of Cobbs), the calculated phase difference is used to select a minimum possible value for the printing offset of all of the colors.

Hackleman in view of Koike is combinable with Cobbs because they are from the same field of endeavor, namely the correction of misregistration and misalignment in color printers. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the method taught by Hackleman in view of Koike to include the specific type of scaling, optimizing and pen selection taught by Cobbs. The motivation for doing so would have been to improve printing in the case of paper slippage (column 9, lines 20-21 of Cobbs). Therefore, it would have been obvious to combine Cobbs with Hackleman in view of Koike to obtain the invention as specified in claim 31.

Further regarding claim 32: Cobbs further discloses that said smallest of said values is determined taking into account the maximum available number of printing elements in the corresponding array (column 10, lines 1-7 of Cobbs). Since

particular pens have to be specifically selected (column 10, lines 1-7 of Cobbs), the maximum available number of printing elements in the corresponding array must inherently be taken into account.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James A. Thompson whose telephone number is 571-272-7441. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David K. Moore can be reached on 571-272-7437. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

James A. Thompson
Examiner
Art Unit 2624

27 October 2005

THOMAS D
~~[illegible]~~ LEE
PRIMARY EXAMINER